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ISSUE NO. 3: CAPITAL COSTS FOR FERTILIZER PLANTS

Issue paper *

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1. BACKGROUND

The First Consultation on the Fertilizer Industry recognized the high costs involved in establishing fertilizer plants and indicated that measures to bring down investment costs should be urgently considered, after looking into the justification of some recent increases in the prices of equipment and engineering services. An Expert Group Meeting on Fertilizer Plant Cost Reduction and Ways to Mobilize Sufficient Financing was convened in Vienna, Austria, 11-14 April 1978 (report ID/WG.274/17/Rev.1) to discuss this issue.

The Meeting found that the cost of nitrogenous fertilizer plants built in many developed countries rose 3% to 10% above the inflation rate in the period 1970-1977, whilst the cost of plant erection, off-sites and other expenses increased faster than the cost of equipment. The main findings of the Meeting are summarized in Annex A.

The Second Consultation on the Fertilizer Industry considered the progress made by UNIDO in examining ways to reduce the high cost of fertilizer plants. The cost of establishing fertilizer plants in most developed countries in 1977 was stated to be between two and three times the cost of the same plant in 1970, and in developing countries the increase in cost was higher. That made it difficult to demonstrate the economic feasibility of fertilizer projects. Therefore, the Second Consultation recommended that UNIDO should continue to examine ways in which the cost of new fertilizer projects might be reduced to make the projects more viable.

The Third Consultation on the Fertilizer Industry was reported by the UNIDO Secretariat that little further work had been undertaken on this issue, but all available information indicated that such costs had continued to increase rapidly since 1977 and were likely to continue doing so.

The Third Consultation noted that the escalating capital costs for fertilizer plants were partly due to inflation, but not all. Construction and equipment costs had risen faster than inflation, and reduced the capabilities of developing countries to build new fertilizer plants. It recommended that UNIDO examines in-depth the capital costs for fertilizer plants covering topics

such as equipment, construction and start-up, infrastructure, formulation and construction of fertilizer projects.

In accordance with the recommendations of the Third Consultation, UNIDO is presenting to the Fourth Consultation a study on "capital cost control of fertilizer plants in developing countries".

In addition, three reference papers depicting the impact on production costs of these higher fertilizer plant costs have been prepared by analysing the practical experiences of the World Bank. Those reference papers are "investment and production cost for fertilizers", "the effect of energy and investment costs on total fertilizer production costs" and "the changing structure of the international fertilizer industry".

2. THE DOCUMENT

Capital Cost Control of fertilizer plants in developing countries (UNIDO/IS.422)

The objective of the study is to assess the actual increases in cost and time delays of fertilizer projects built in developing countries, to determine the causes of these increases and delays and to compare them with those of identical projects built in the developed countries.

Based on empirical data collected by UNIDO from plant owners, engineering contractors and licensors, international financial and specialized organizations, the pattern of cost structure of fertilizer plants was established and organized in comparable forms. Due to the complexity of the subject and the multiplicity of elements that influences the investment cost of a fertilizer plant, a thorough analysis was made for each of the cost components, the execution function related to engineering, procurement, construction and commissioning as well as the role of the parties involved in determining the cost, namely the client, the contractor, the vendor, the licensor, the financial institution and the state.

All cost components were analysed in detail and the cost structure of various fertilizer projects were constructed indicating the weight of each cost element in the total cost of these projects. Detail analyses were made on

construction cost elements, inflation, and management-related cost elements, including delays and their influence on cost escalation and time overrun were assessed. Adjustments were made in order to render comparable fertilizer plants built at various time periods and with different technology, capacity and feedstock.

These analyses show, for instance, that the cost structure of an 1,000 mtpd ammonia - 1,700 mtpd urea complex built in a developing country is as follows: equipment 31%, engineering services 14%, plant construction 14%, freight/ insurance 6%, taxes/custom duties 7%, site preparation 3%, pre-operational activities 10%, outside the plant infrastructure 5% and interest charges 10%. The battery limits cost is 85% of the total plant cost. The location influenced cost components represent 29% of the battery limits plant cost, which show the need for a thorough pre-investment work including site selection. When comparing the costs of the above complex built in a developed country and in a developing country, the latter comprising one complex built under normal conditions and another complex suffering from severe delays, the following picture emerges:

	Developed Country	Developing Country	
		normal delay	severe delay
Battery limits cost (%)	100	116	138
Total plant cost (%)	100	157	187

The influence of poor management during plant construction is shown by the 16 per cent increase in the battery limits cost over the cost of a similar project in a developed country, whereas the additional increase in cost which is attributed to severe delay is 22 per cent. These figures take on larger proportions when the total plant cost is considered going up to 57 and 87 per cent respectively. Improved management of project implementation, including types of contract, would be a key factor in reducing cost and time overruns.

Answers obtained from fertilizer plant owners in developing countries (86 per cent of the answers) indicate that late delivery of equipment was the most important item responsible for delays in project implementation. However,

answers received from contractors and consultants from developed countries (85 per cent of the answers) did not list late delivery of equipment as a major factor causing delay. Both plant owners and contractors/consultants agree, however, that poor management is the main cause of cost escalation.

The study indicates that cost overruns occurred in 80 per cent of the reported plants and that the average increase in cost was 100 per cent over the original cost estimates. These same plants suffered from time overruns which was on the average 120 per cent higher than the original schedule.

Moreover, it appears that the trouble rate increases proportionally with the size of plants constructed in developing countries.

Two factors were identified as the main causes of cost escalations and time overruns, namely insufficient pre-investment preparation and poor management during construction. A third, but less important factor, is inadequate preparation to put the project into commercial operation.

3. THE ISSUE

The study demonstrates that the main cause of cost escalation of fertilizer projects in developing countries is due to project management, for which responsibility is shared by the parties involved in project implementation. Therefore, the type of contract used and the assigning of responsibilities, liabilities and compensations to the parties in the contract, becomes an essential factor in deciding on total project cost and level of cost escalation which seems to increase with increases in plant size.

In particular, better monitoring and control could be exercised on delivery of equipment and materials which accounted for major time delays and consequently cost overruns. The UNIDO Model Contracts on this industry could assist in remedying this situation.

The study also identified the cost of financing as having a marked effect on cost escalation. This requires an improvement on the terms and conditions

of loans to facilitate its repayment within the financial possibilities of the plant.

In addition, pre-investment activities including site selection, were found to have an important impact on cost escalation. The programme of co-operation among developing countries in the fertilizer industry, in particular the exchange of experiences between plant managers and project managers, could assist in redressing this situation coupled to other technical assistance activities.

Finally, the progressive development of domestic capabilities and skills in developing countries concerning the design, construction and furnishing of fertilizer plants, could have a positive impact on plant cost reduction.

Participants at the Fourth Consultation are thus invited:

(a) to examine the study on capital cost control presented and advise the parties concerned on further steps to be taken to remedy the identified main causes of fertilizer plant cost escalation in developing countries;

(b) to advise UNIDO on the need to prepare a pre-contracting manual for the fertilizer industry to complement the four model contracts for the construction of a fertilizer plant already prepared;

(c) to advise UNIDO on the need to prepare comprehensive guidelines for capital cost minimization and cost control of fertilizer projects;

(d) to advise UNIDO on further studies on this issue such as the impact of indigenisation on the capital cost of fertilizer plants in developing countries and the development of a system of cost indexation of fertilizer projects built at different locations.

ANNEX A

Summary of Conclusions and Recommendations of the Expert Group Meeting on Fertilizer Plant Cost Reduction and Ways to Mobilize Sufficient Financing (report ID/WG.274/17/Rev.1)

(a) Engineering services and equipment account for about two thirds of the cost of a plant. Competitive bidding could help to reduce these costs, although procurement expenses might then be increased. A discussion between owners in developing countries on all aspects of plant procurement and implementation would be useful.

(b) It would be useful to standardize plant capacities. Equipment suppliers should be persuaded to standardize rotating machines and major equipment items to the greatest possible extent.

(c) Plants built in developing countries used a high degree of automation and instrumentation. Such use should be subject to careful analysis bearing in mind the importance of safety for proper operation of the plant.

(d) Delays at any stage in implementation of a fertilizer project increase the cost of a plant. Increased co-operation between the purchaser and contractor was desirable.

(e) Inadequate project planning could increase plant costs and inexperienced buyers should seek the advice of consulting engineers.

(f) Import duties and taxes added as much as 10 per cent to the total cost of a plant in some developing countries. Governments should consider removing or reducing this burden on plant costs.

(g) The investment cost of some fertilizer plants was increased by the cost of constructing infrastructure outside the battery limits of the plant. Such investment should be undertaken by the Government and/or on concessionary terms of finance.

(h) Greater use should be made of indigenous engineering personnel; where fabricating capabilities existed, local suppliers should be used to the maximum extent possible.

(i) Civil works accounted for approximately 10 to 15 per cent of the cost of the plant. Savings could be achieved by careful site selection and plant lay-out, appropriate design and improved construction methods.

(j) The high cost of expatriate personnel of engineering contractors deputed to the site, as well as those of vendors service men, could be reduced by giving commitments on the rate and period that they would be fielded at the time of signing the contract for constructing the plant.

(k) Use the same design engineering drawings for the construction of a set of duplicate plants.